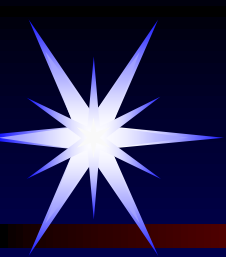




Spectra analysis Visual Spec

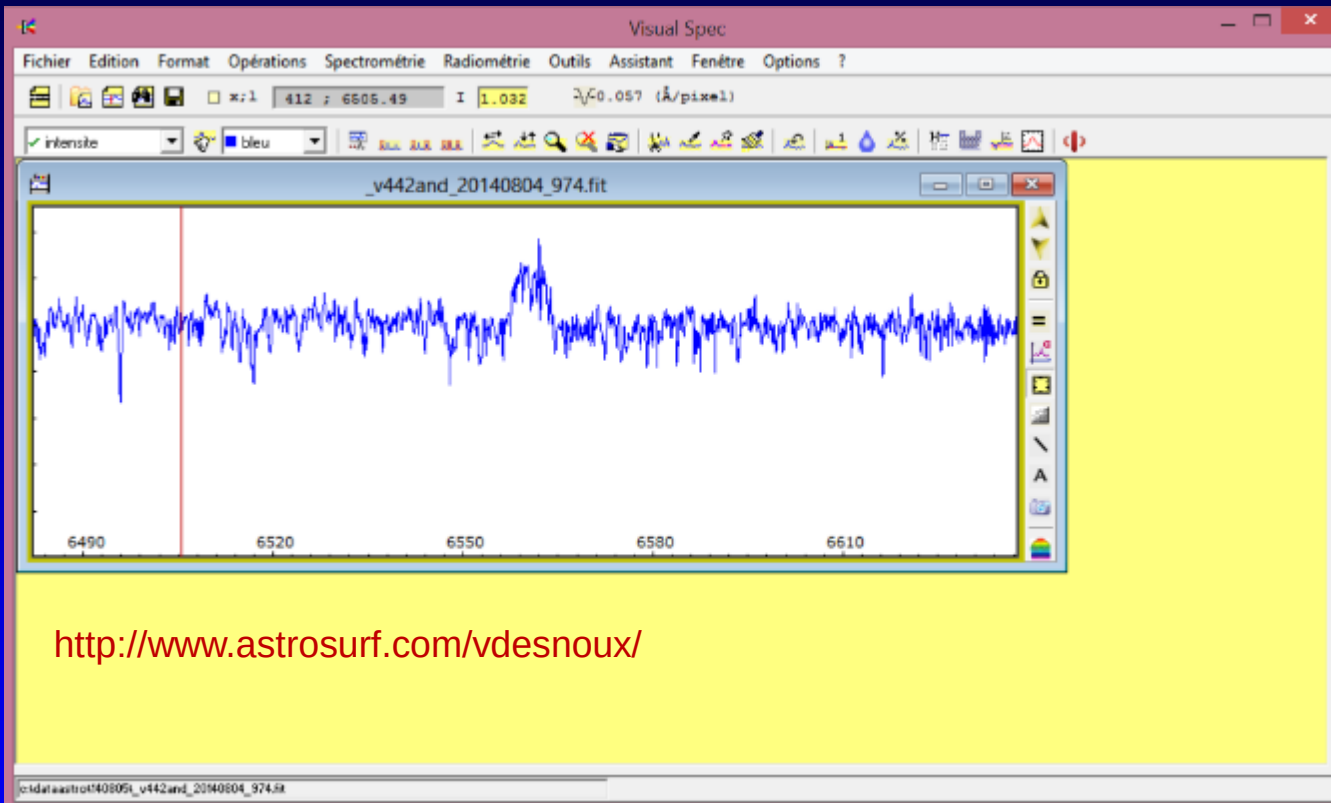
Sacramento Mountains Spectroscopy Workshop
22-24 feb 2019

Valérie Desnoux
valerie.desnoux@free.fr



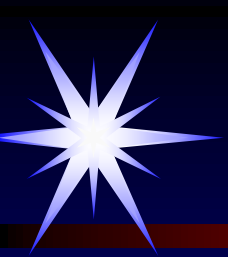
Visual Spec...

First
version in
1995



<http://www.astrosurf.com/vdesnoux/>

... Since version 4.4.2 installation has improved



Spectral diversity



Spectral type, temperature

Line identification

Nova

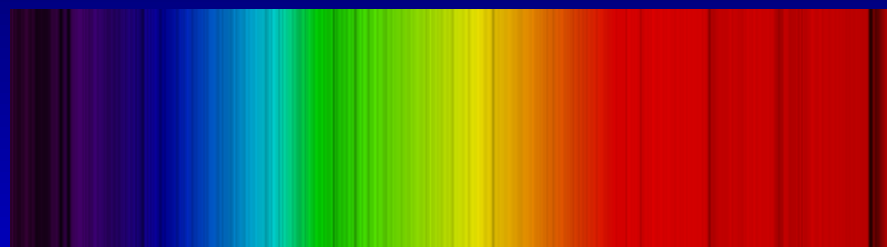
Carbon star

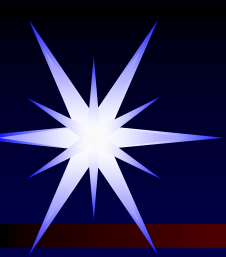
Planetary nebulae

Supernova

Quasar

... and Be stars

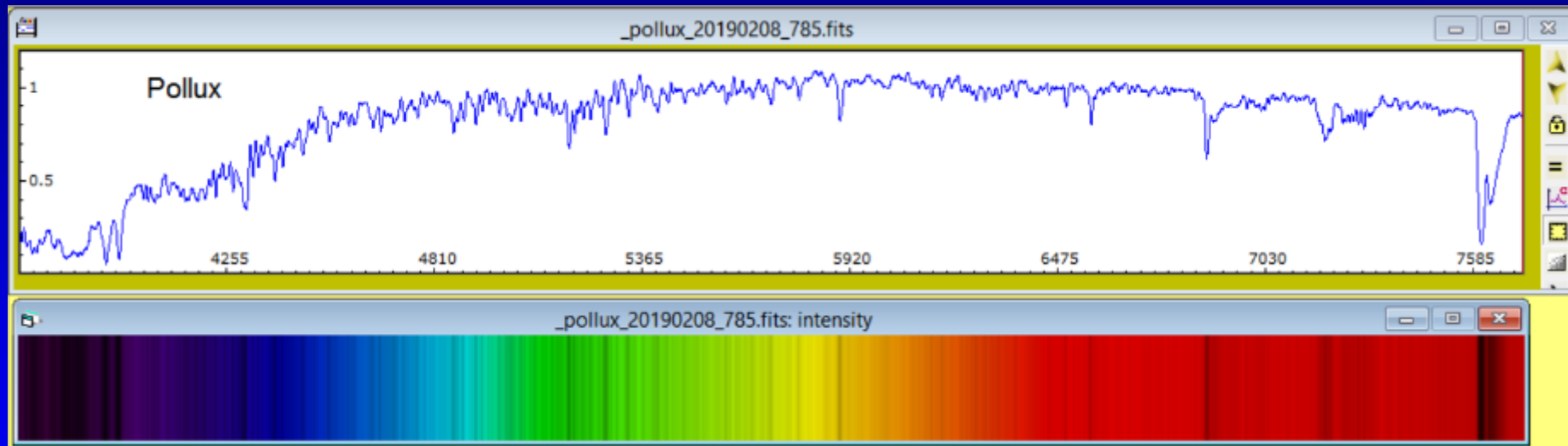


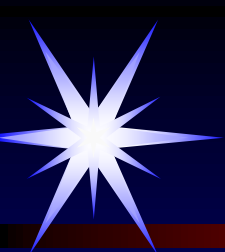


Pollux



Tool > Synthesis to get a black& white synthetic image from the profile
Right click in image > color to get it in color based on wavelength





Pollux

Assistant	Tools	Batch	Window
Mendeleiev...			
Elements...	Ctrl+E		
Library...	Ctrl+L		
Spectral type...	Ctrl+T		
Coordinates...			
Console	Ctrl+Q		
Script box			
Latest script			
BeSS query...	F2		
BeSS list query			
CDS query...	F3		
Line analysis			
Run Spectrum*			

 Portal Simbad Vizier Aladin X-Match Other Help

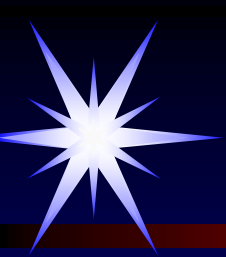
pollux

other query modes : Identifier query Coordinate query Criteria query Reference query Basic query Script submission TAP Output options Help

Query : pollux

Available data : Basic data Identifiers Plot & images Bibliography Measurements External archives Notes

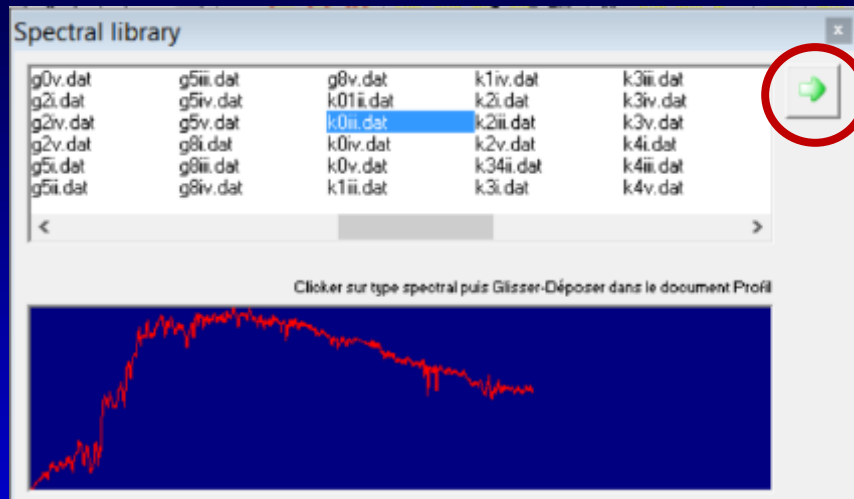
Basic data :
*** bet Gem -- High proper-motion Star**
Other object types: * (*, AG, ...), PM* (Ref, LHS, ...), ** (ADS, CCDM, ...), IR (IRAS, IRC, ...), V* (CSV, NSV), X (2E, 1RXS), UV (TD1)
ICRS coord. (ep=2000) : 07 45 18.94987 +28 01 34.3160 (Optical) [2.64 1.58 63] A 2007A&A...474..653V
FK5 coord. (ep=2000 eq=2000) : 07 45 18.94987 +28 01 34.3160 [2.64 1.58 63]
192.22928086 +23.40626629 [2.64 1.58 63]
Proper motions mas/yr : -626.55 -45.80 [0.30 0.18 0] A 2007A&A...474..653V
Radial velocity / Redshift / cz : V(km/s) 3.23 [0.02] / z(spectroscopic) 0.000011 [0.000000] / cz 3.23 [0.02]
(Opt) A 2015A&A...574A..50J
Parallaxes (mas): 96.54 [0.27] A 2007A&A...474..653V
Spectral type: K0IIIB B 989ApJS...71..245K



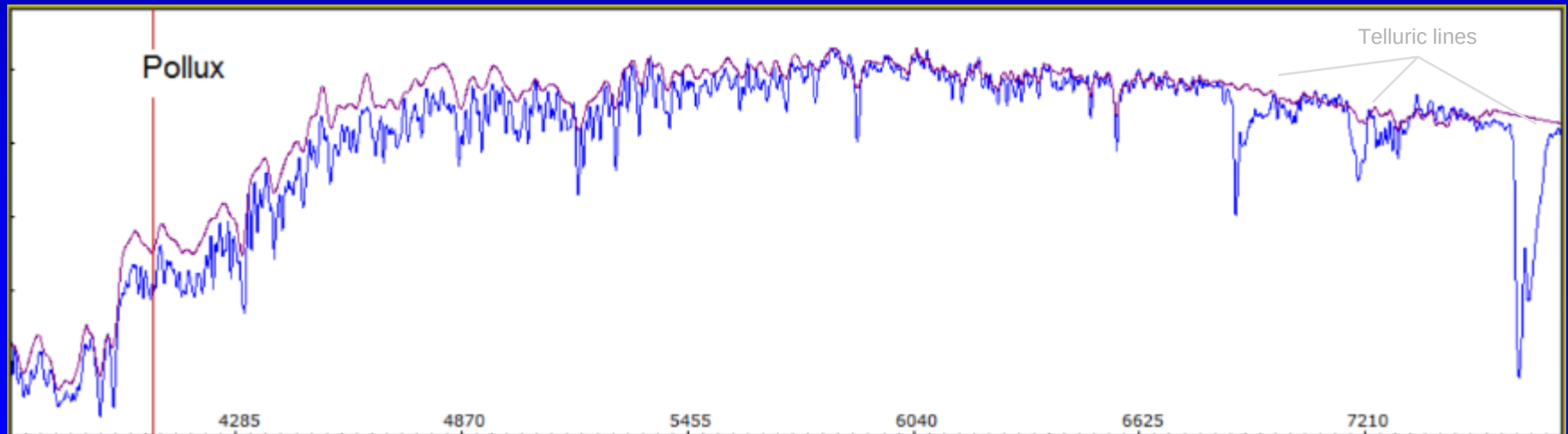
Spectral type library

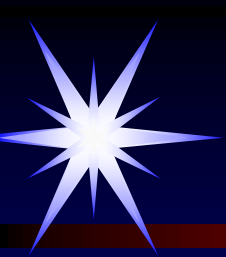


Assistant	Tools	Batch	Window
Mendeleviev...			
Elements...		Ctrl+E	
Library...		Ctrl+L	
Spectral type...		Ctrl+T	
Coordinates...			
Console		Ctrl+Q	
Script box			
Latest script			
BeSS query...		F2	
BeSS list query			
CDS query...		F3	
Line analysis			
Run Spectrum®			



Library from A.J. PICKLES
5 Angströms sampling





Element identification

- **CRC Handbook of Chemistry & Physics**

- VI/16 Line Spectra of the Elements (Reader+ 1980-1981)

Reader J. & Corliss Ch.H.

<61st ed., CRC Handbook of Chemistry & Physics (1980--81)>

- **Line catalog in stellar object**

- VI/71A Revised version of the ILLSS Catalogue (Coluzzi 1993-1999)

COLUZZI R: 1993

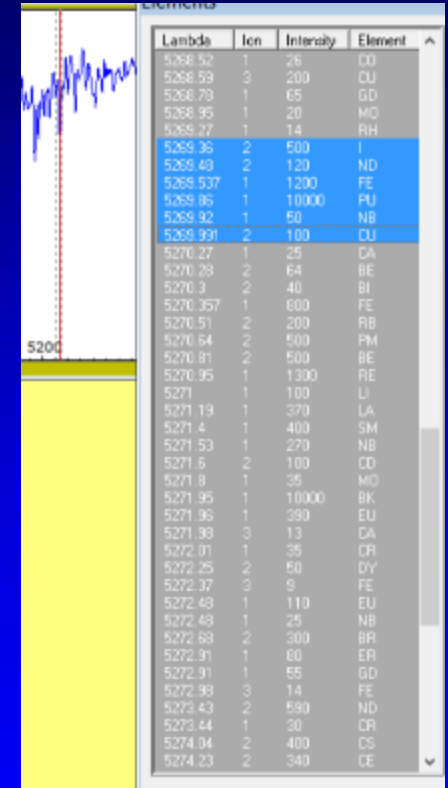
<Bull. Inf. CDS 43, 7>

The screenshot shows a software window titled "Elements". It contains a table with the following columns: Lambda, Ion, Intensity, and Element. The table lists various spectral lines with their corresponding wavelengths, ionization states, intensities, and element symbols.

Lambda	Ion	Intensity	Element
3690.28	1	1000	V
3690.34	1	5500	PD
3690.56	2	50	YB
3690.59	1	240	MO
3690.624	1	100	TH
3690.65	1	580	HO
3690.65	3	30	KR
3690.7	1	1900	RH
3691.15	2	610	TB
3691.48	1	1500	RE
3691.92	2	540	U
3691.95	1	340	HO
3692.22	2	270	SM
3692.22	1	1500	V
3692.36	1	9400	RH
3692.5	2	300	PM
3692.53	1	170	Y
3692.566	1	170	TH
3692.64	2	180	MO
3692.65	2	7900	ER
3692.73	1	10000	BK
3692.76	1	300	TC
3692.95	2	300	TB
3693.49	1	40	XE
3693.53	3	250	BR
3693.58	1	450	TB
3693.67	1	280	MN
3693.7	2	330	U
3693.91	2	180	IN
3693.93	2	1	GA
3693.93	1	90	NI

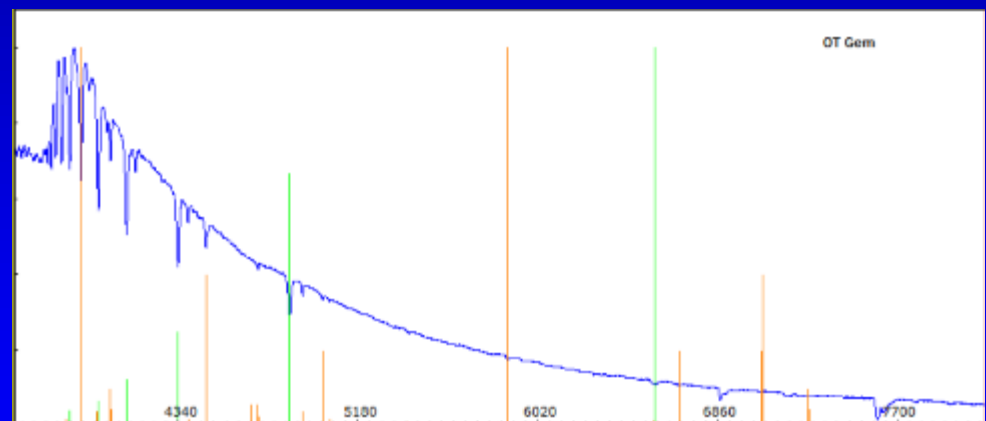
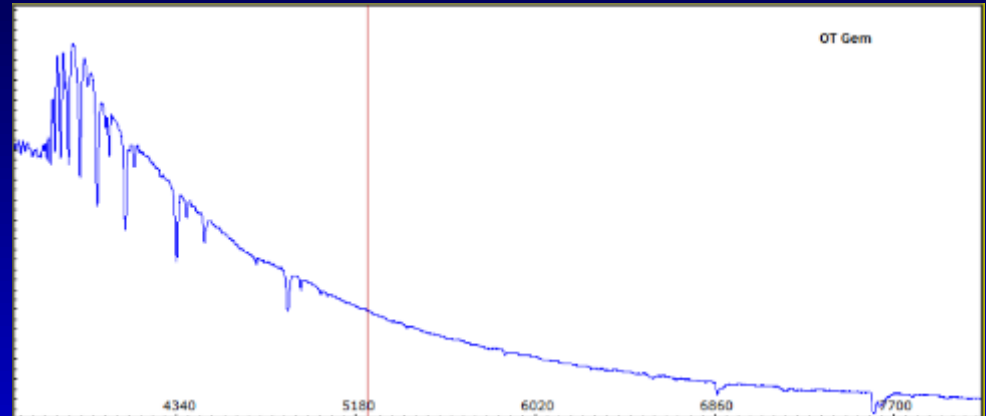
On the right side of the window, there are several controls:

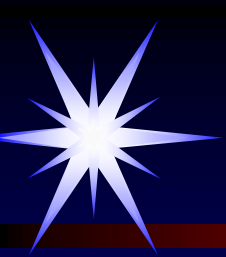
- Line**: A dropdown menu currently set to "element".
- List**: Fields for "from" (3690) and "to" (7742), with icons for a lightbulb, a download arrow, and an eye.
- selection**: A checkbox that is currently unchecked.
- Eléments**: A list of element symbols with checkboxes: FR, GA, GD, GE, H (checked), HE, HF.
- Buttons**: "Sort", "Export", and "Close".





H	Mendeleviev table																He				
Li	Be															B	C	N	O	F	Ne
Na	Mg															Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr				
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe				
Cs	Ba	*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn				
Fr	Ra	**	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	UUb	UUt	UUq	UUp	UUh	UUs	UUo				
			*																		
			**	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb				
				Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No				



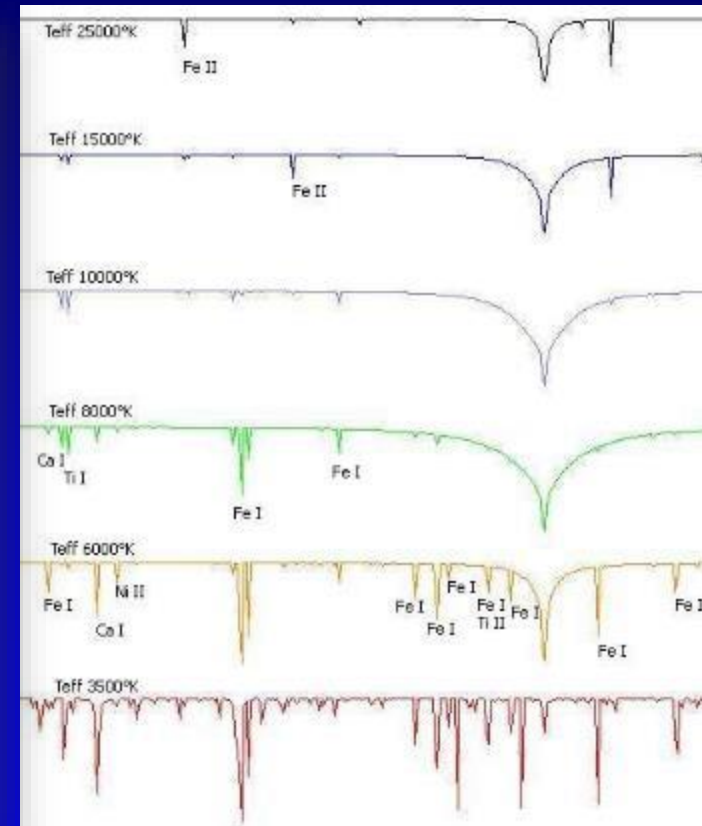
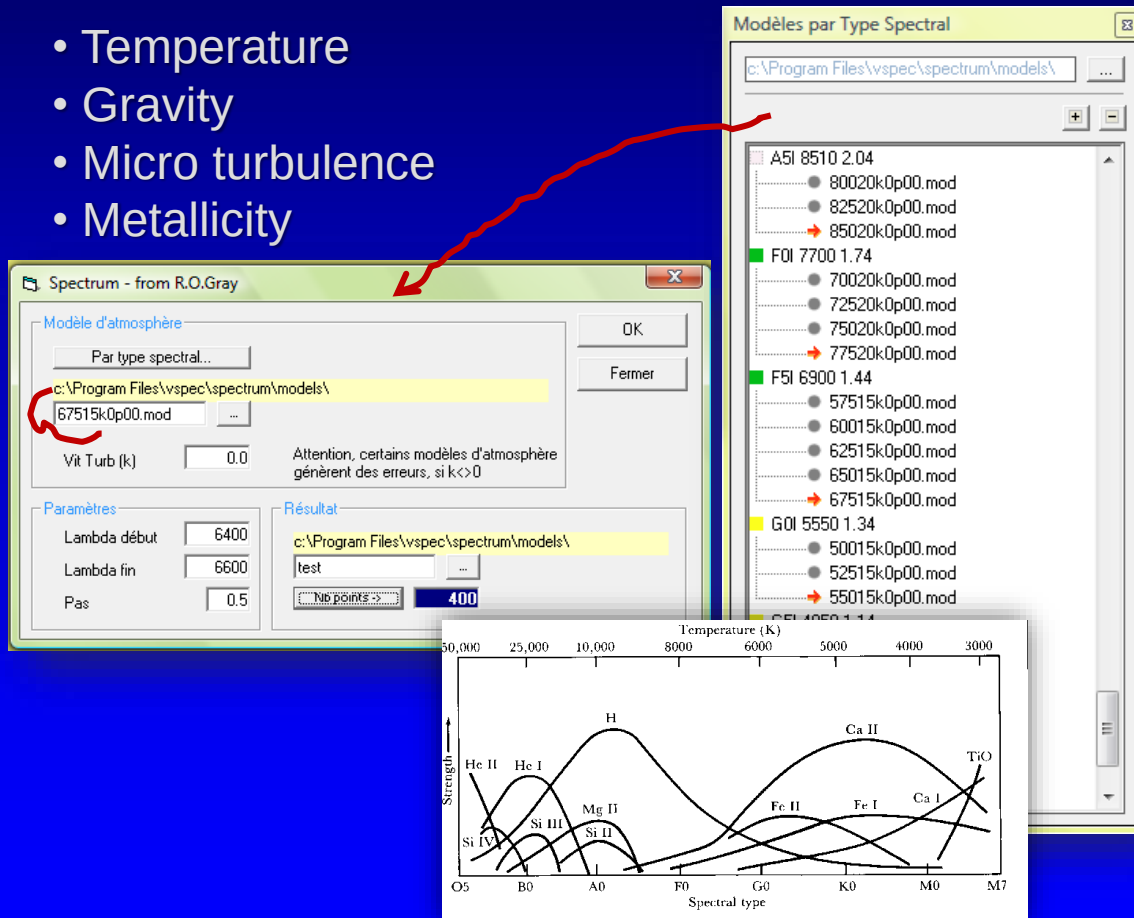


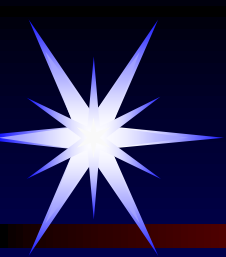
Spectrum Simulation

Star spectra simulation software from R.O.Gray

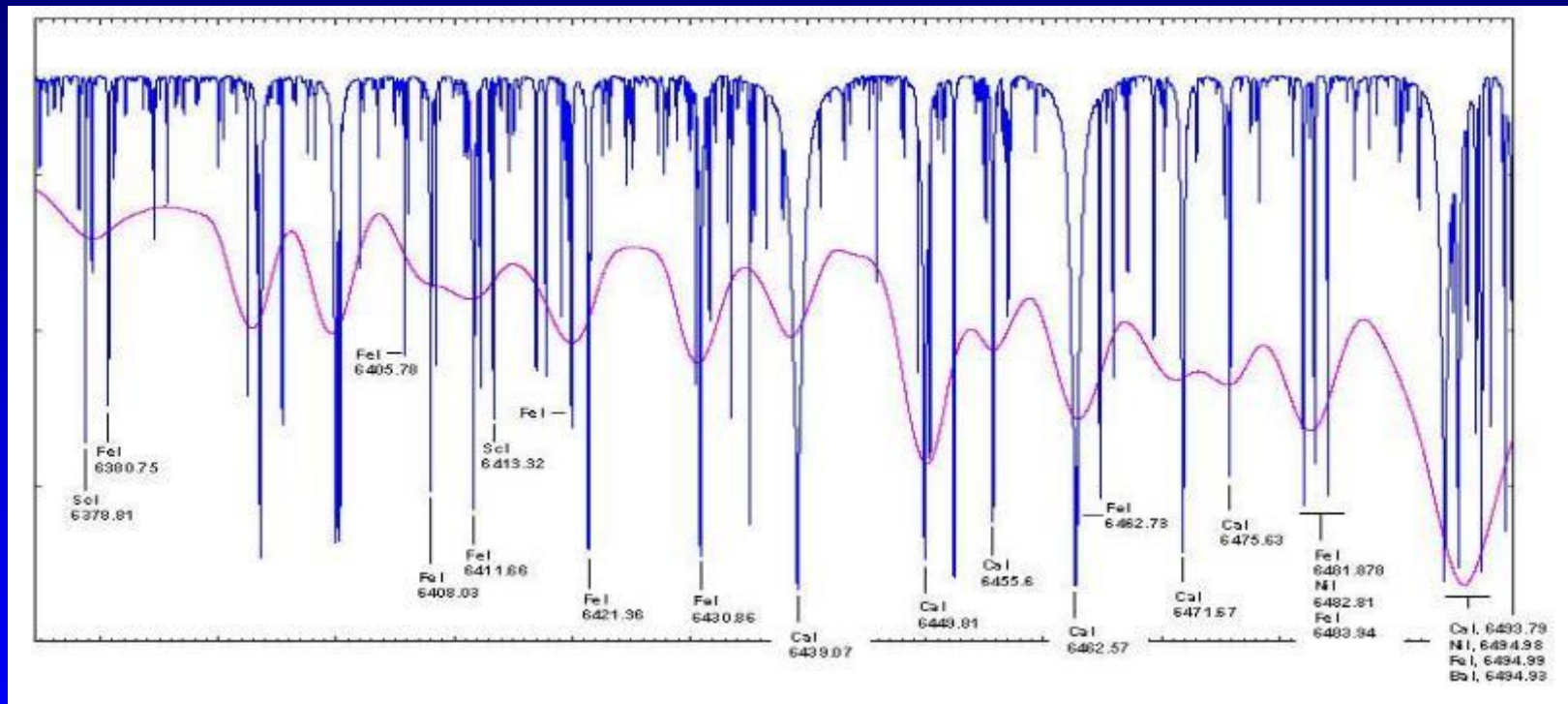
<http://www.appstate.edu/~grayro/spectrum/spectrum.html>

- Temperature
- Gravity
- Micro turbulence
- Metallicity

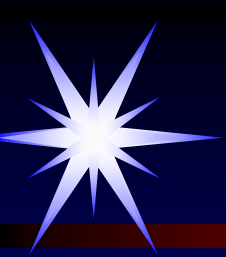




Be careful !

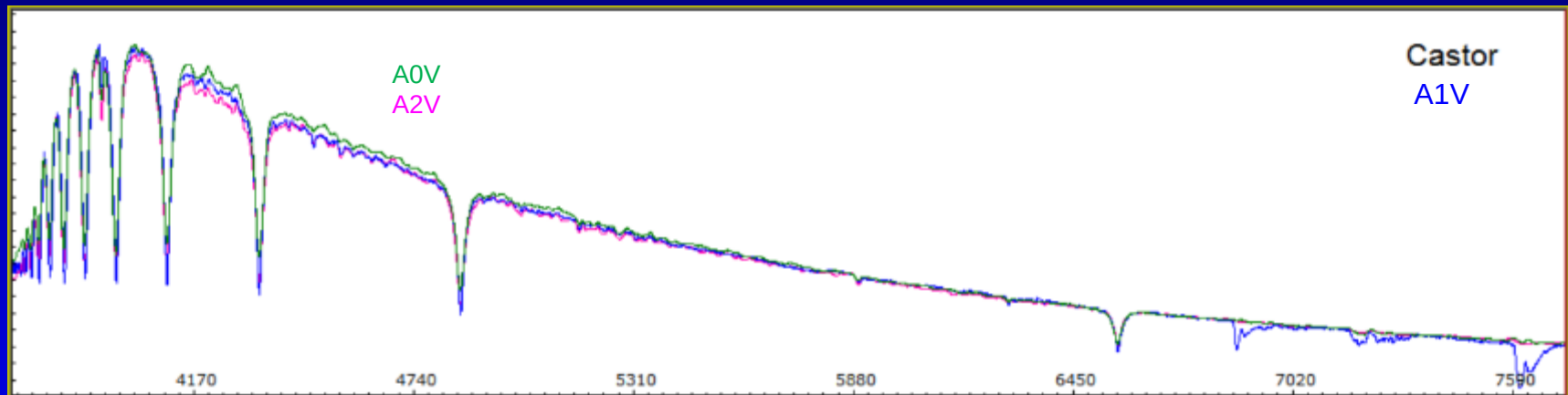


On some stars the identification can be almost impossible...

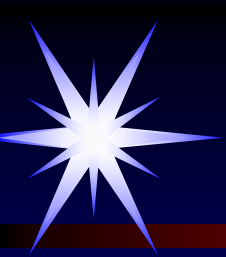


Planck temperature

Pickles Library to find the best spectral profile fit
CDS Simbad direct connection... Castor is A1V star

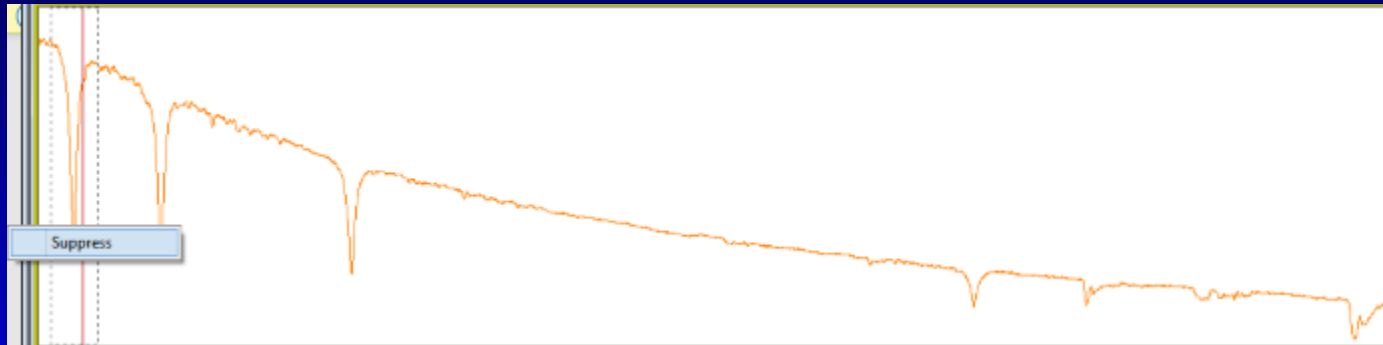


Or Extract the continuum and fit the best planck profile $f(\text{temp})$

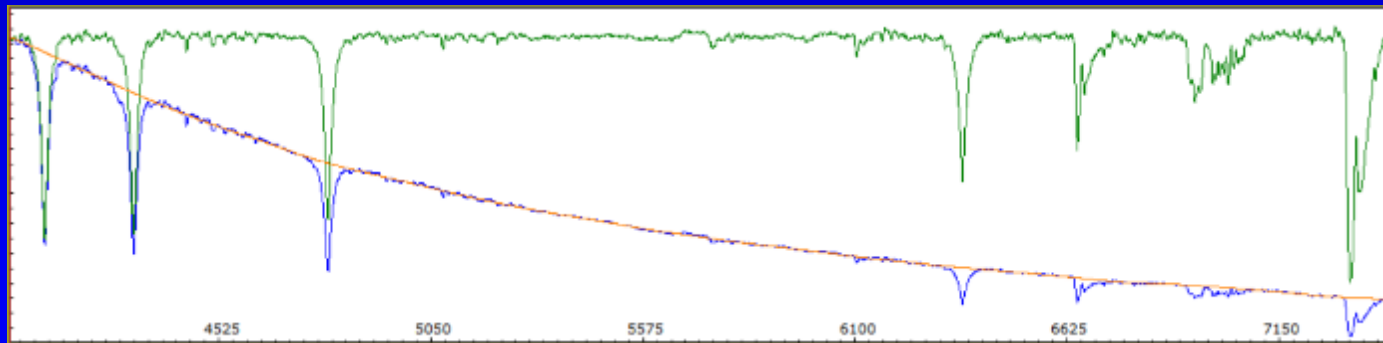


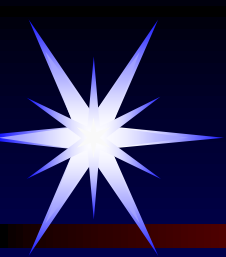
Continuum extraction

Radiometry > compute continuum



Spline filtering to fit the low frequencies

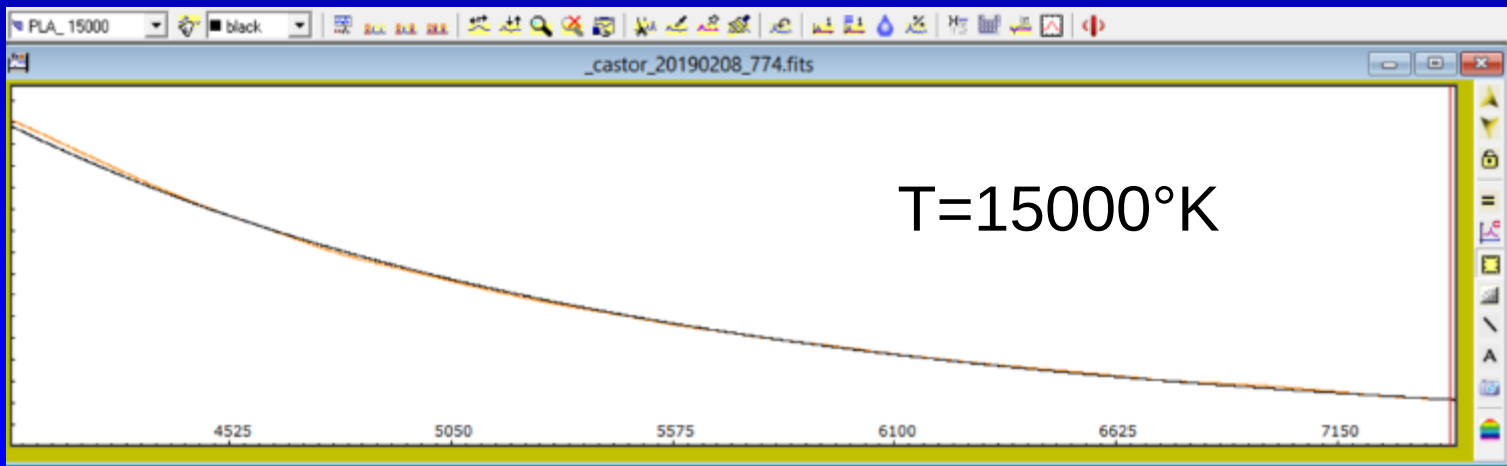
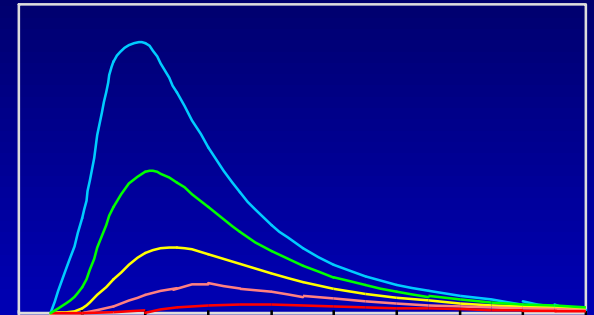
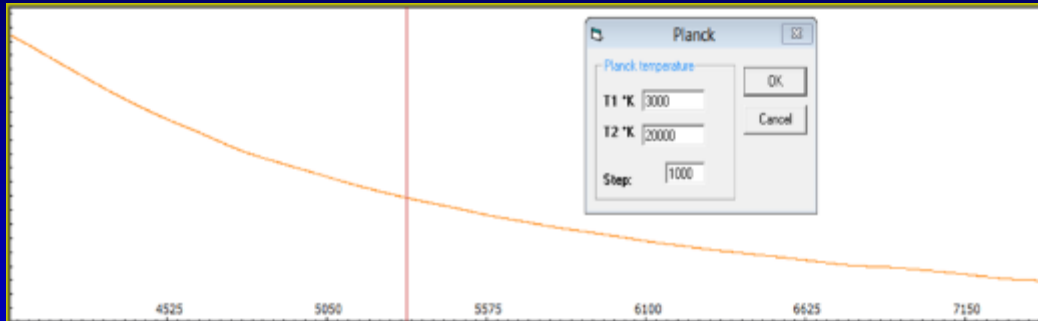


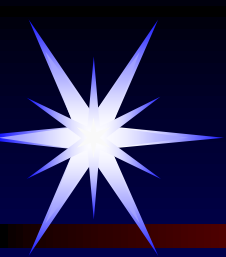


Planck profile fit

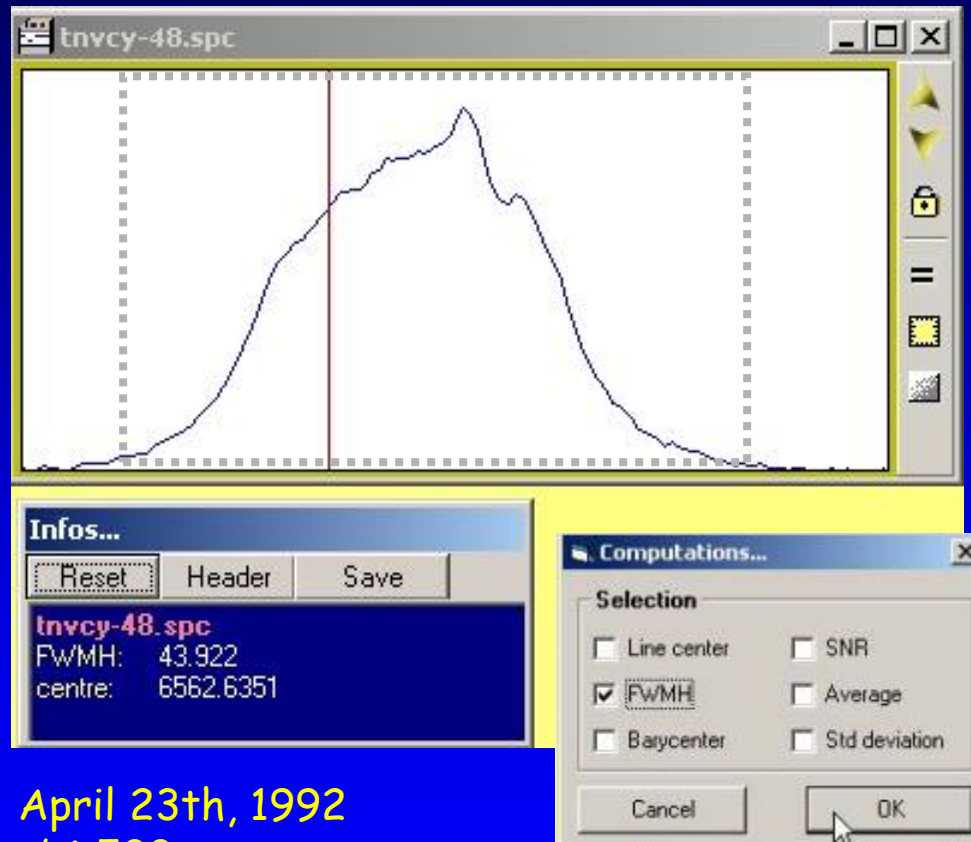


Radiometry > auto Planck





Nova Cygnii 1992



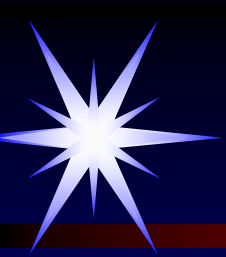
April 23th, 1992
obj:500mm
Réseau 600 tr/mm
T60 pic du midi

$$\Delta V = \frac{\Delta \lambda}{\lambda} \cdot c$$

$c = 300\,000 \text{ km/s}$
 $\lambda_{\text{ref}} = 6562.63 \text{ \AA}$
 $\Delta \lambda = 44 \text{ \AA}$

$V = 2008 \text{ km/s} \pm 100 \text{ km/s}$

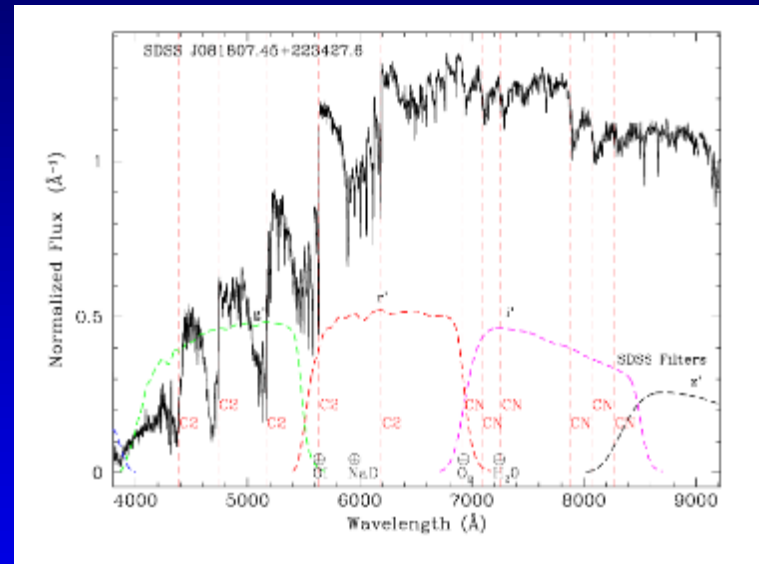
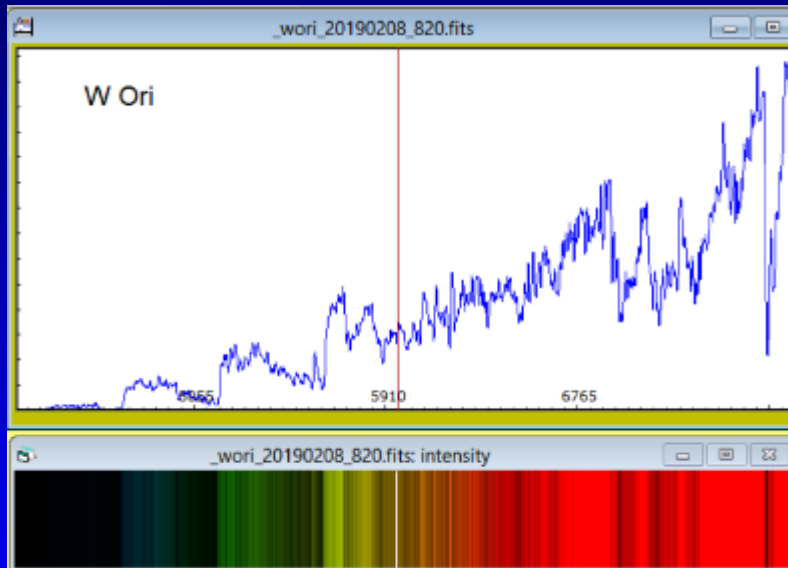
UAI telegram
expansion of 2050 km/s...



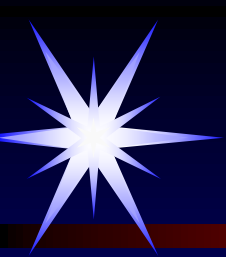
Carbon star



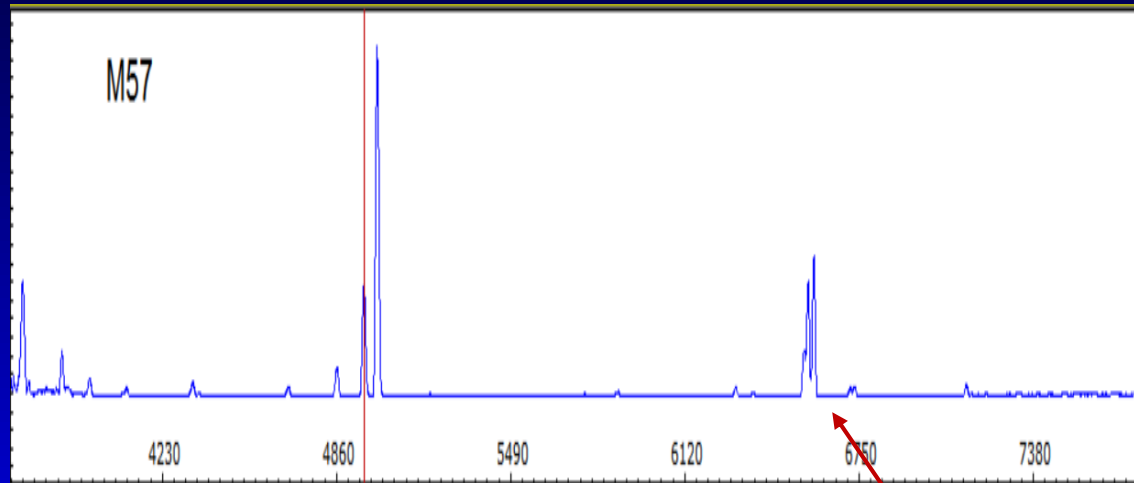
W Ori ... C-N5 B



These are red giants, near the end of their lives, in which there is an excess of carbon in the atmosphere.



Planetary nebulae



4541.59	2	30	He II
4640	3	120	N III
4685.68	2	30	He II
4711.34	4	50	[Ar IV]
4740.2	4	50	[Ar IV]
4861.33	1	80	H I
4958.92	3	50	[O III]
5006.85	3	50	[O III]
5199.2	1	50	[N I]
5411.52	2	5	He II
5517.7	3	50	[Cl III]
5577.4	1	50	[O I]
5754.57	2	50	[N II]

6300.32	1	50	[O I]
6312.1	3	50	[S III]
6363.81	1	50	[O I]
6548.06	2	50	[N II]
6562.82	1	120	H I
6583.39	2	50	[N II]
6678.15	1	100	He I
6716.5	2	50	[S II]
6730.7	2	50	[S II]
7005.7	5	50	[Ar V]
7065.3	1	30	He I
7135.8	3	50	[Ar III]
7319.92	2	50	[O II]

Elements

Lambda	Ion	Intensity	Element
3835.39	1	5	H I
3868.76	3	50	[Ne III]
3889.05	1	6	H I
3967.47	3	50	[Ne III]
3970.07	1	8	H I
4068.6	2	50	[S II]
4101.74	1	15	H I
4340.47	1	30	H I
4363.21	3	50	[O III]
4471.48	1	25	He I
4541.59	2	30	He II
4640	3	120	N III
4685.68	2	30	He II
4711.34	4	50	[Ar IV]
4740.2	4	50	[Ar IV]
4861.33	1	80	H I
4958.92	3	50	[O III]
5006.85	3	50	[O III]
5199.2	1	50	[N I]
5411.52	2	5	He II
5517.7	3	50	[Cl III]
5577.4	1	50	[O I]
5754.57	2	50	[N II]
5875.65	1	500	He I
6300.32	1	50	[O I]
6312.1	3	50	[S III]
6363.81	1	50	[O I]
6548.06	2	50	[N II]
6562.82	1	120	H I
6583.39	2	50	[N II]
6730.7	2	50	[S II]

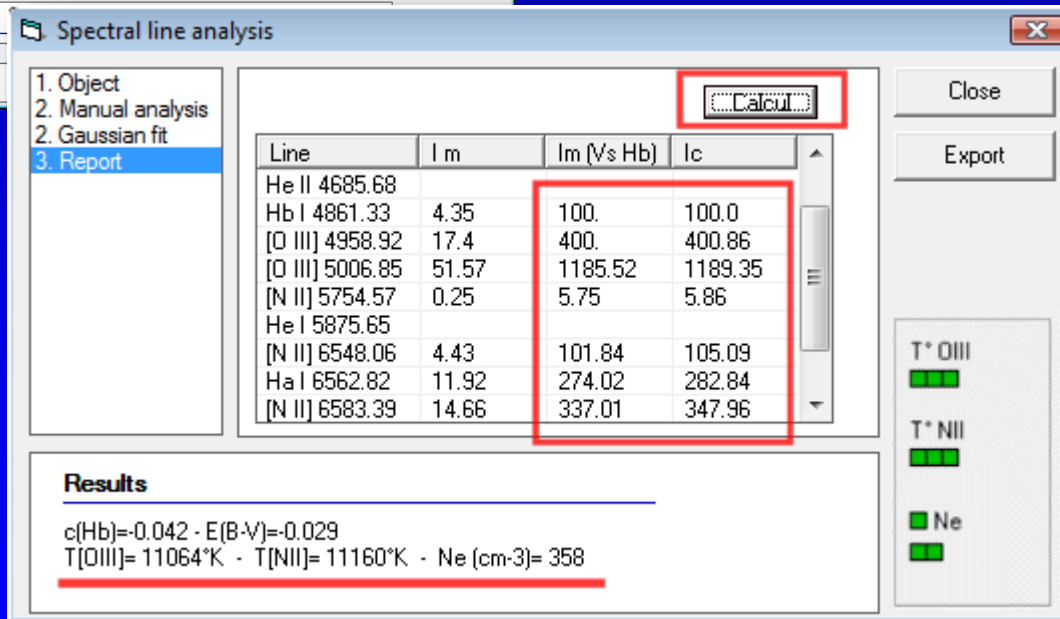
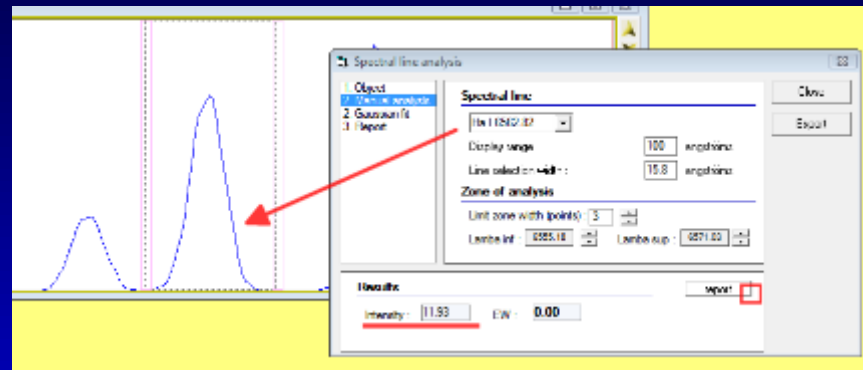
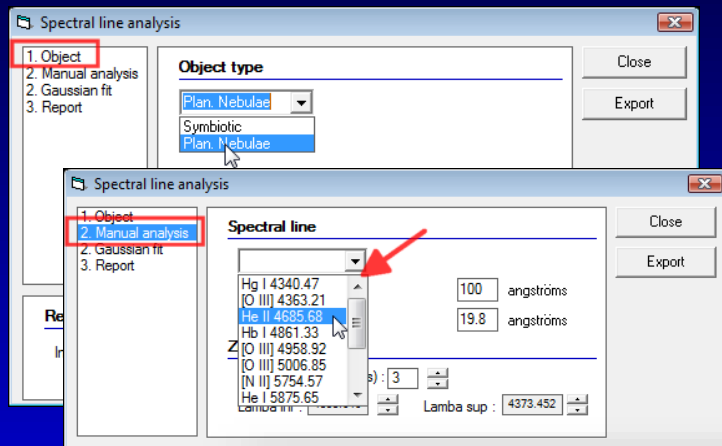
Line: element, element, lineident, sun, atmos, symb, nebplan, W/R, Hires3000

selection

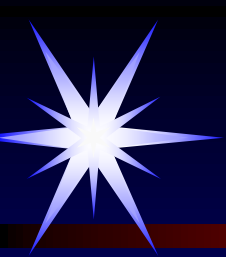
Eléments: AC, AG, AL, AM, AR, AS, AU

Sort, Export, Close

Planetary neb assistant



_messier27_20120814_967.fit			
Messier 27			
2012-08-14T23:12:33			
cbuil			
OHP			
FSQ85 LISA ATIK460EX			
Line	Imes	Io	Ic
Hg I 4340.47			
[O III] 4363.2:	0.39	9.09	8.97
He II 4685.68	1.69	39.39	39.2
Hb I 4861.33	4.29	100	99.99
[O III] 4958.9:	17.9	417.25	418.29
[O III] 5006.8:	53.49	1246.85	1251.49
[N II] 5754.57	0.35	8.16	8.33
He I 5875.65	0.43	10.02	10.26
[N II] 6548.06	4.41	102.8	106.59
Ha I 6562.82	11.7	272.73	282.86
[N II] 6583.39	14.32	333.8	346.32
[S II] 6716.5	1.07	24.94	25.93
[S II] 6730.7	0.89	20.75	21.58
c(Hb)	-0.048		
E(B-V)	-0.033		
T([OIII])K	10586		
T([NII]) K	13241		
Ne(cm-3)	340		

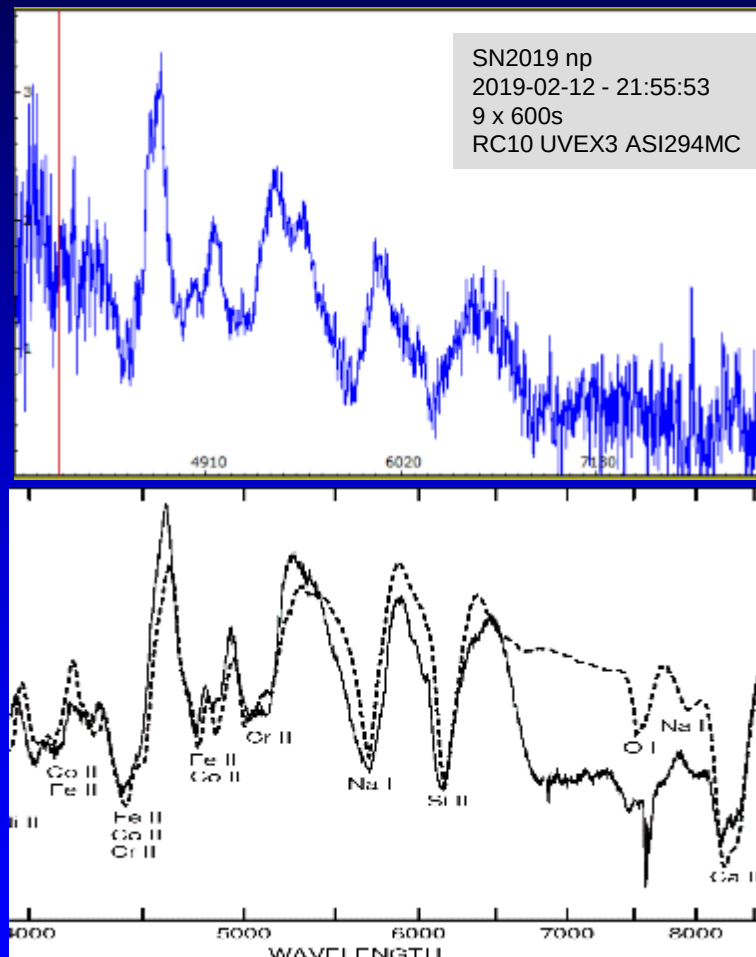


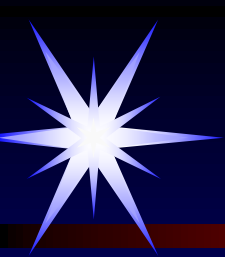
Supernova



Koichi Itagaki (Japan)
Type Ia ($z=0.00452$)
Discovered 2019/01/09.665

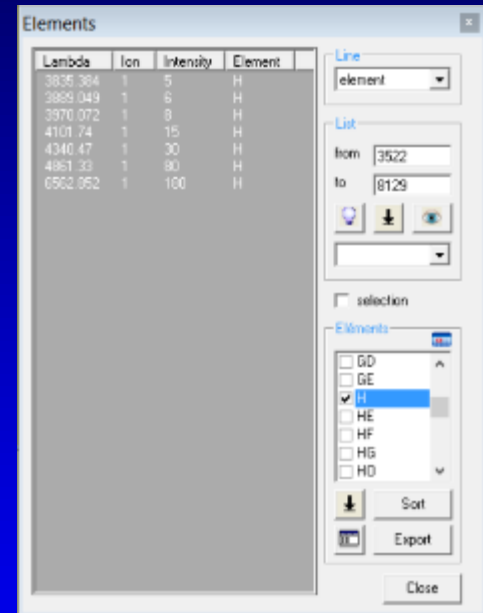
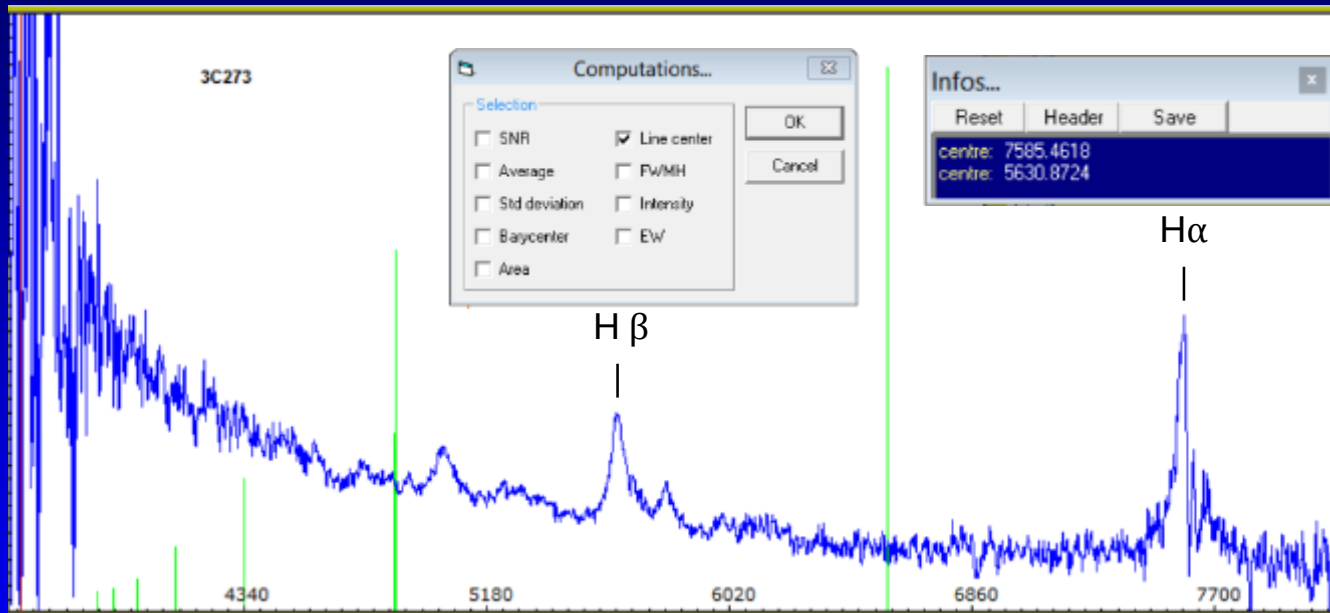
White dwarf which accretes enough mass to exceed the Chandrasekhar limit and collapses into a neutron star





Quasar

- Z redshift : $(\lambda_1 - \lambda_0) / \lambda_0$



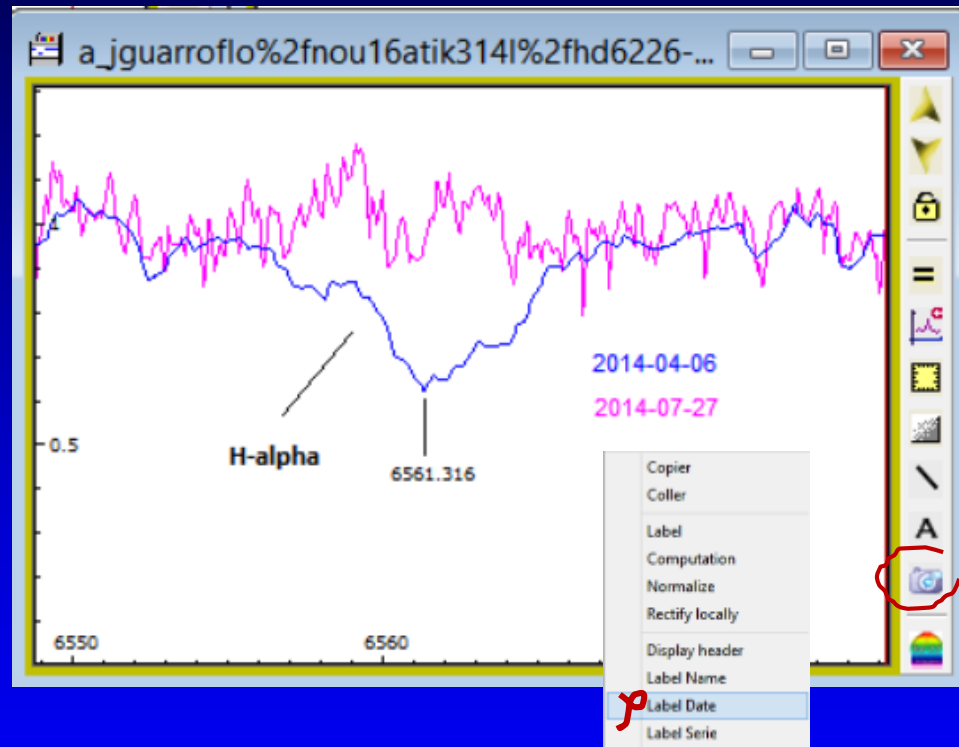
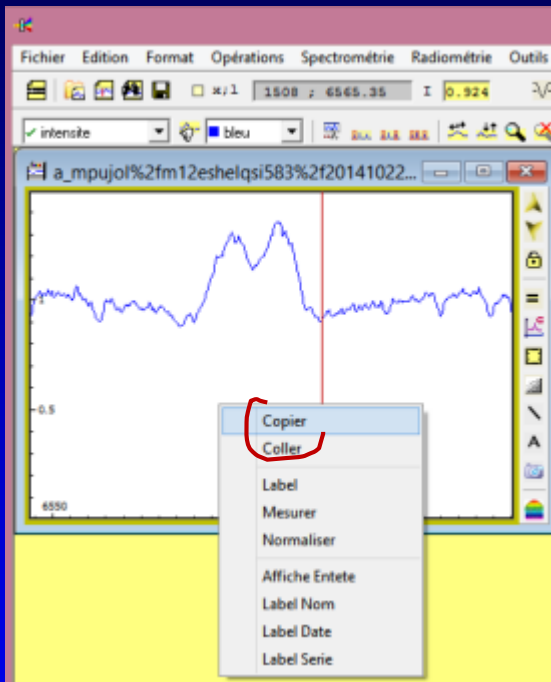
Halpha... $(7585 - 6562) / 6562 = 0.156$

Hbeta... $(5630 - 4861) / 4861 = 0.158$

$Z = 0.157 \pm 0.01$

Radial velocity / Redshift / cz : V(km/s) 43751 [20] / z(~) 0.158339 [0.000067] / cz 47468.84 [20.09]
C 1992ApJS...83...29S

Comparison

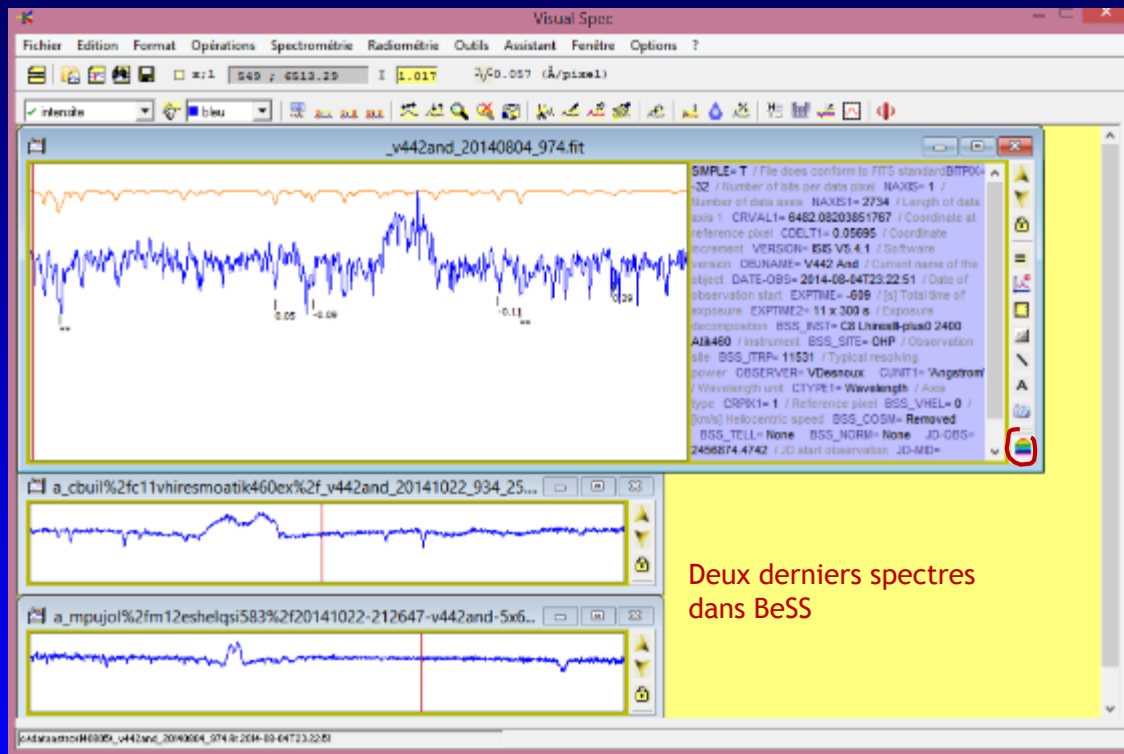


As easy as a cut & paste...

Scale the spectra on a common region of the continuum

Additional tool for date labeling and png export

Be verification

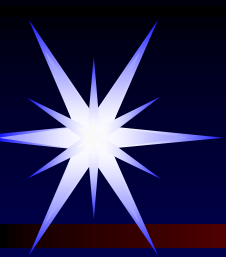


Automatic adaption to the resolution and central wavelength



Magic button

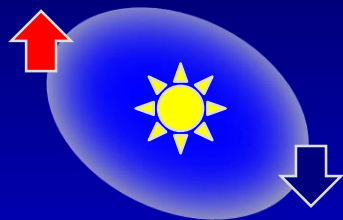
- Display the last two spectra from BeSS database
- Detect telluric lines and display shift versus theoretical position
- Display Fits header



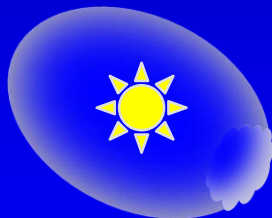
H-alpha gold mine



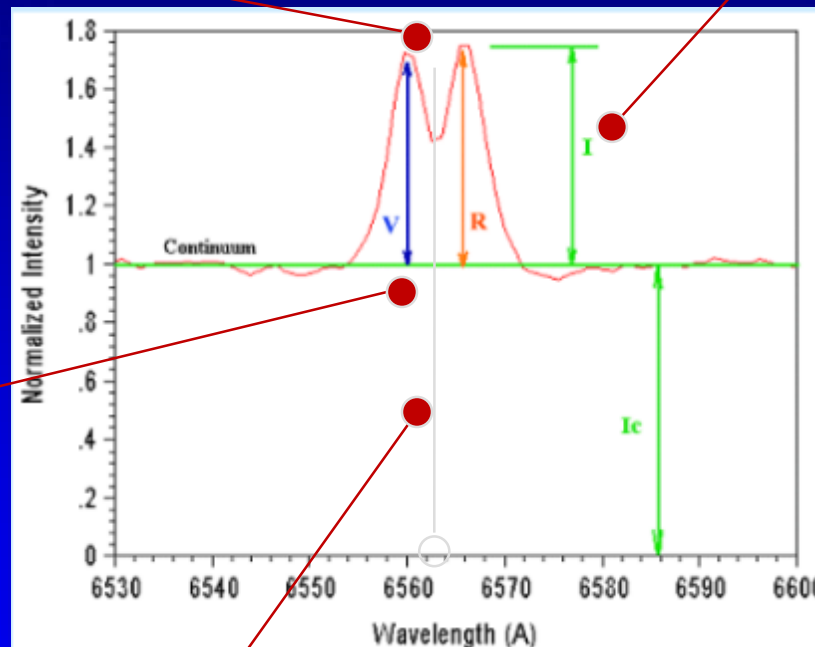
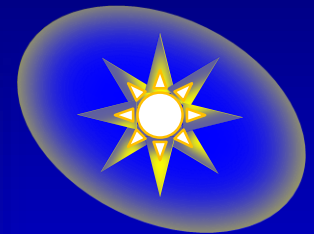
Peak separation V/R
Disk radius



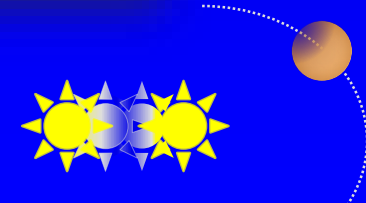
Asymmetry V/R
Disk density

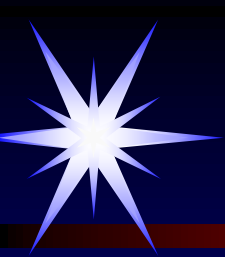


Emission, Intensity
Matter ejection

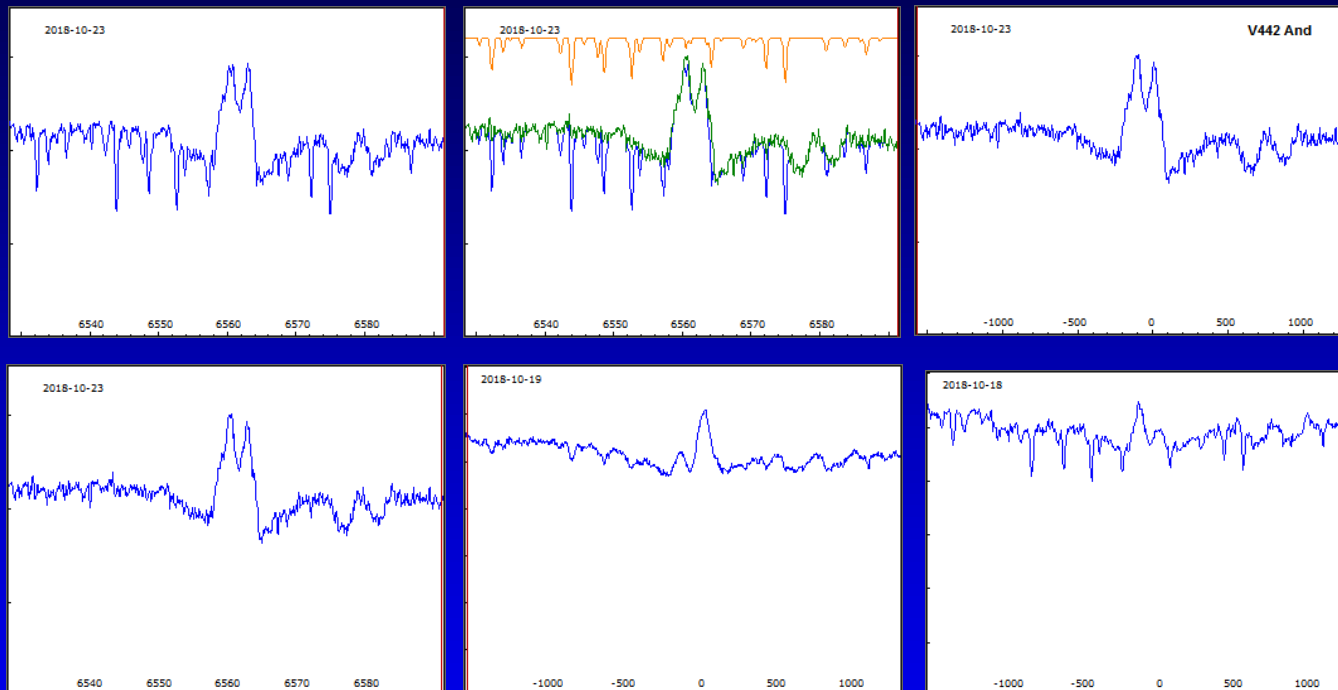


Spectral shift
Radiale velocity – « motion » of the star



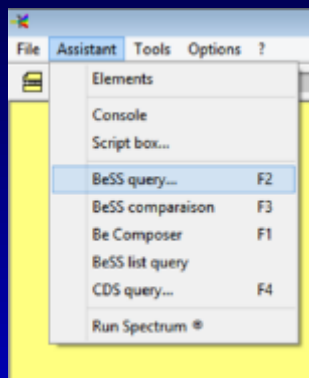


Measurement on V442 And



	2018-10-23 18:11:23.170	2018-10-19 19:13:25.913	2018-10-18 19:26:20.115
Ecart V-R	118 km s ⁻¹	164 kms ⁻¹	133 kms ⁻¹
Ratio V/R	0.83	0.65	1.1

Connection to BeSS



BeSS Query

Object: HD 6226 HD 6226 ☐ No check Simbad

Period: From: 2017-10-28 From 1 year To: 2018-10-28 Today (format ex: 2007-02-28)

Wavelength: Contains: 6563 (Angströms) H-Alpha ☒ Only HR

☒ Query

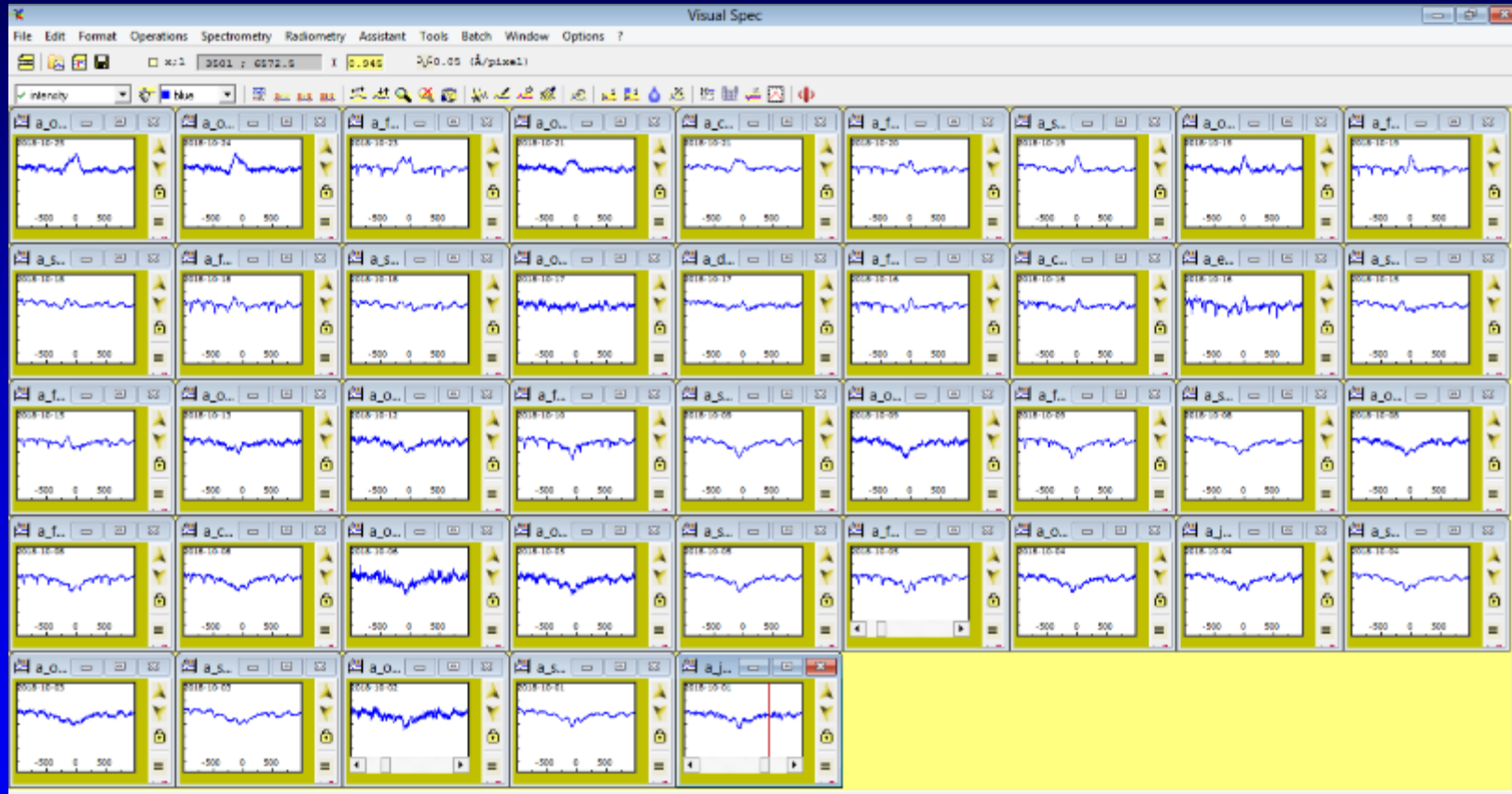
BeSS Spectral Service at ObsPM found 217 spectra SSAP

Fichiers	Date	Lamb
☒ A_othizy%2Feshelatik460%2F_v442and_20181025_757_34.fits	2018-10-25 20:12:08	6507.5
☒ A_othizy%2Feshelatik460%2F_v442and_20181024_868_34.fits	2018-10-24 22:10:3...	6507.5
☒ A_fhouper%2Fc11hiresii1942400t35qs16s%2Fbess_HD6226_2018102...	2018-10-23 19:11:4...	6520.5
☒ A_jguarroflo%2F16remotinx460ex%2F_v442and_20181021_886_34.fits	2018-10-21 23:11:14	6397.5
☒ A_othizy%2Feshelatik460%2F_v442and_20181021_871_34.fits	2018-10-21 22:36:22	6507.5
☒ A_ckreider%2Fcdk17hires460ex%2F_v442and_20181021_754_ChK.fits	2018-10-21 21:37:3...	6490.5
☒ A_fhouper%2Fc11hiresii1942400t35qs16s%2Fbess_HD6226_2018102...	2018-10-20 21:28:4...	6520.98
☒ A_scharbonnel%2Ft500f5ap3600ec2eshel112atik460ex%2F_v442and_20...	2018-10-19 23:57:31	6487.5
☒ A_othizy%2Feshelatik460%2F_v442and_20181019_837_34.fits	2018-10-19 22:07:0...	6507.5
☒ A_fhouper%2Fc11hiresii1942400t35qs16s%2Fbess_HD6226_2018101...	2018-10-19 20:13:5...	6521.78
☒ A_scharbonnel%2Ft500f5ap3600ec2eshel112atik460ex%2F_v442and_20...	2018-10-19 00:33:16	6487.5
☒ A_fhouper%2Fc11hiresii1942400t35qs16s%2Fbess_HD6226_2018101...	2018-10-18 20:26:4...	6521.46
☒ A_scharbonnel%2Ft500f5ap3600ec2eshel112atik460ex%2F_v442and_20...	2018-10-18 02:33:1...	6487.5
☒ A_othizy%2Feshelatik460%2F_v442and_20181017_773_34.fits	2018-10-17 19:54:22	6507.5
☒ A_dil%2Fc11hires324002xbinqhying2pro%2F_hd6226_20181017_532_Do...	2018-10-17 18:24:3...	6501.66
☒ A_fhouper%2Fc11hiresii1942400t35qs16s%2Fbess_HD6226_2018101...	2018-10-16 22:21:5...	6519.84
☒ A_ckreider%2Fcdk17hires460ex%2F_v442and_20181016_807_ChK.fits	2018-10-16 21:43:52	6492.86
☒ A_ebryssinck%2Fc11hires2400triussx814%2Fbess_V442And--20181016...	2018-10-16 19:36:4...	6532.49

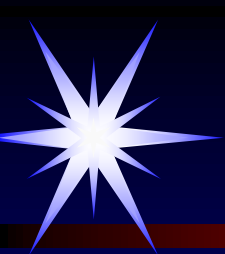
BeSS database
Virtual Observatory

- Time period
- Central wavelength
- Resolution

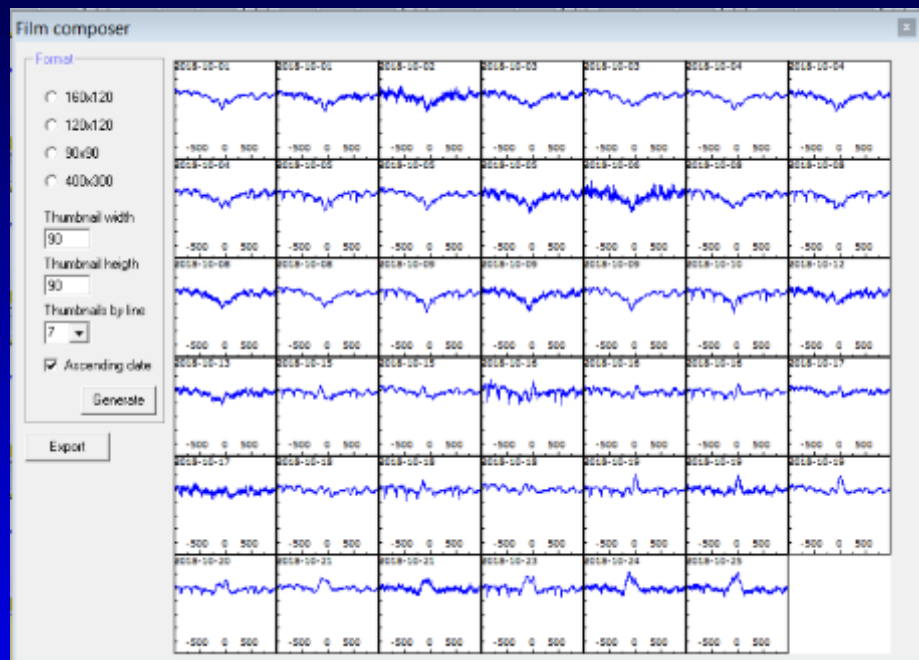
Time serie



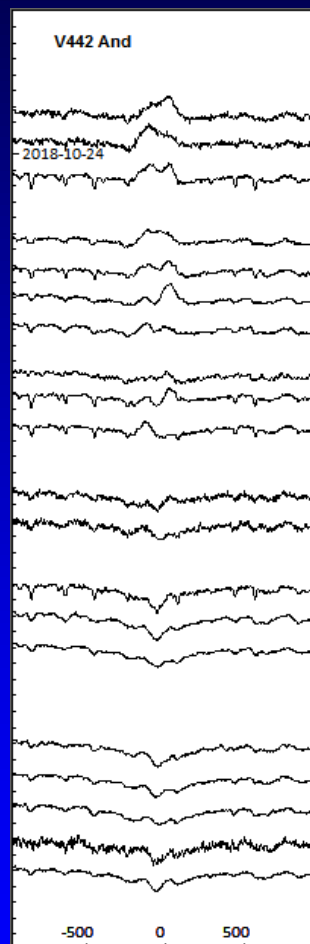
V442 And... from 1st to 26th octobre 2018



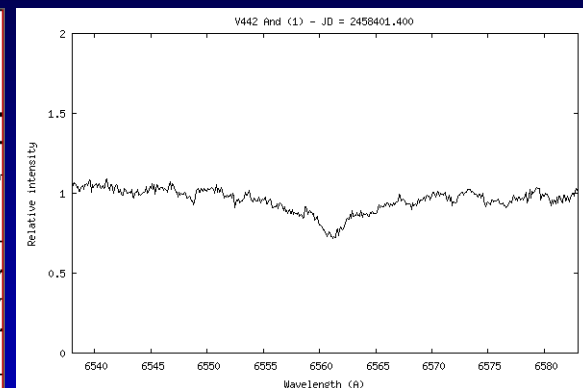
Data presentation



Vspec: Film composer



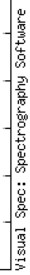
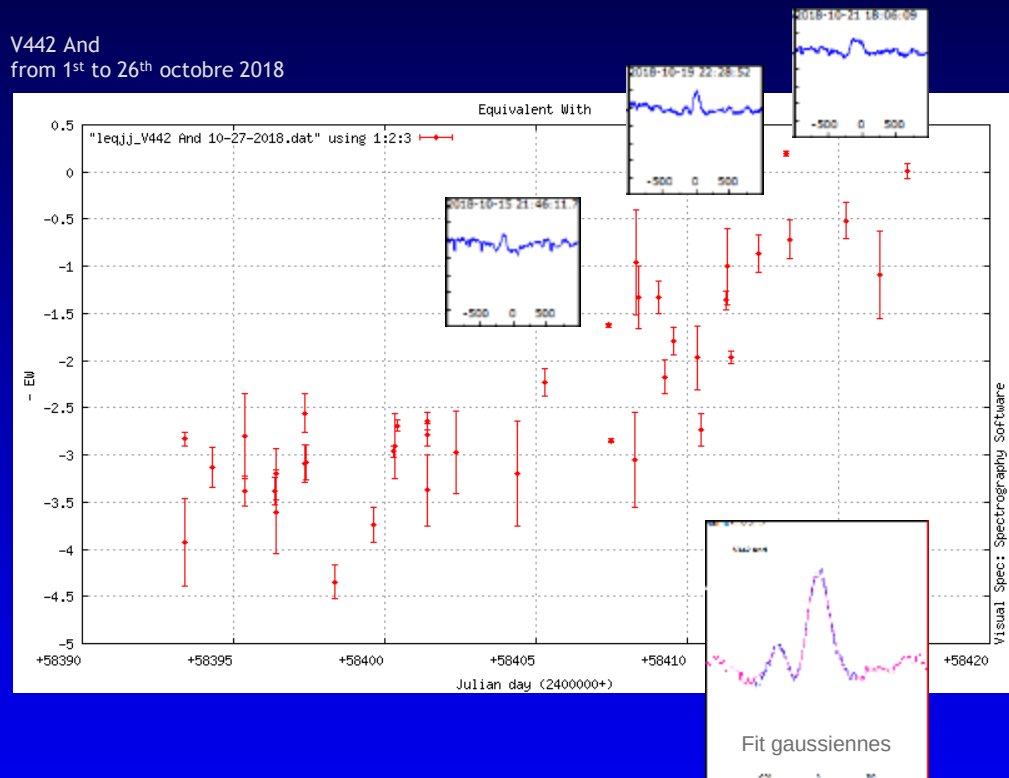
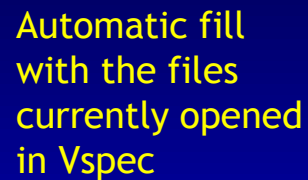
Vspec: Stack & Shift

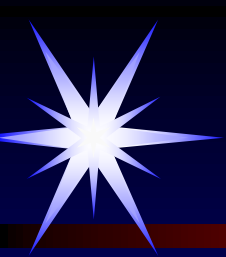


ISIS: Animation

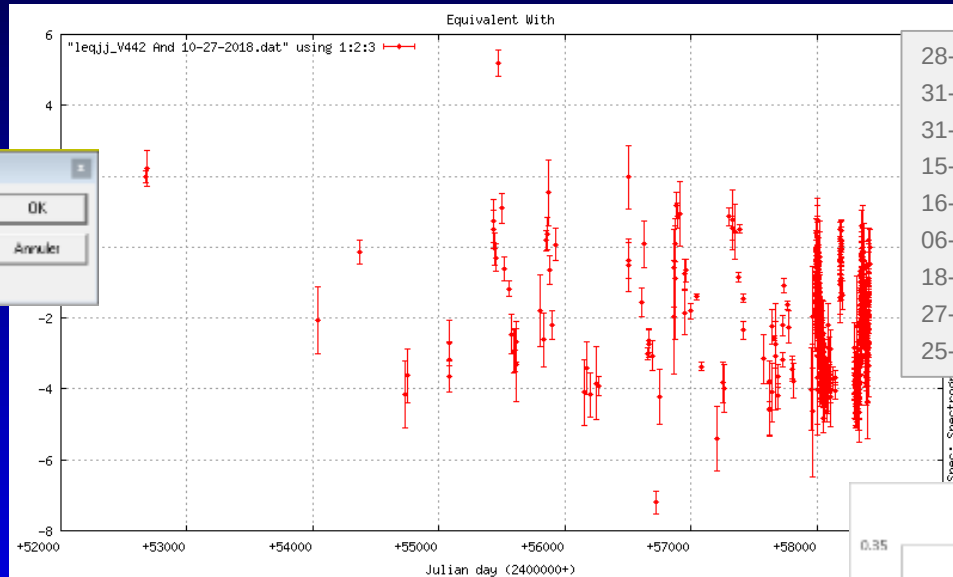
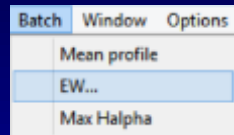


The script box

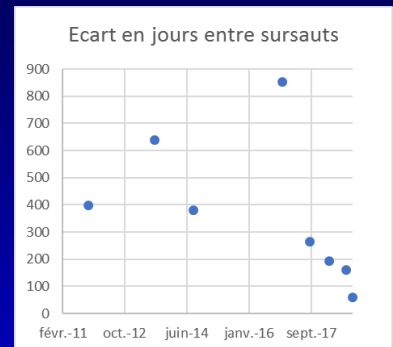




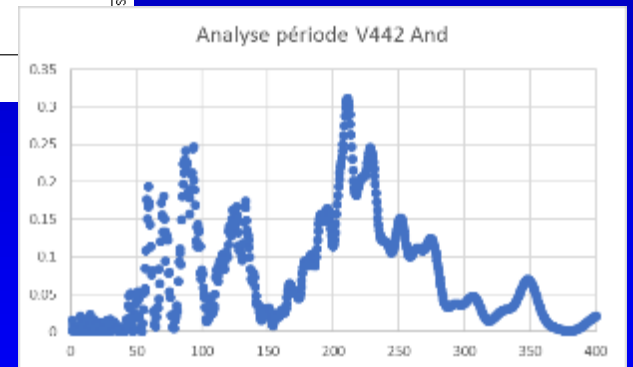
Measurements

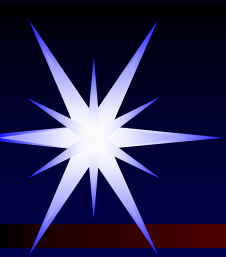


28-09-2010
31-10-2011
31-07-2013
15-08-2014
16-12-2016
06-09-2017
18-03-2018
27-08-2018
25-10-2018



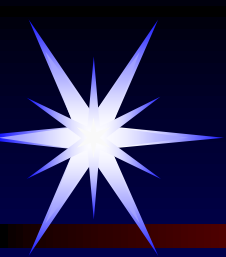
V442 And... multiple cycle of outburst...
Equivalent Width
Period analysis with ISIS





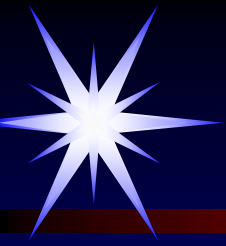
Spectro... in Provence





Spectro in Paris





Spectrographie



Imagination at Work®